

## STAT 540: Homework 2

This homework makes modifications to the `twosamp` function. These should be written as a series of sequential modifications, rather than combining them all in a single function.

NOTE: For each step, you MUST include comments (lines that start with `#`) and otherwise highlight your new statements (with color or bolding) in your code.

1. Alter the function we discussed in class, `twosamp`, so that its output dataframe includes a character variable named `Decision` that stores the decision made by the hypothesis test. That is, the function should report "Reject Null" when appropriate, or "Fail to Reject Null", when appropriate. This should work for any  $\alpha$  level the user chooses, not just the default  $\alpha$  of 0.05.
2. Suppose we want to be able to test one-sided alternative hypotheses ( $\mu_1 - \mu_2 < 0$  or  $\mu_1 - \mu_2 > 0$ ) in addition to the two-sided alternative hypothesis in `twosamp`. Add a new input argument `alternative` so that the function `twosamp` will compute two-sided or one-sided p-values; values of -1,0,1 for `alternative` could correspond to the three different choices for alternative hypotheses. Make the two-sided test the default value of `alternative` in your set of function arguments. Note: Undergraduates should modify only the p-value calculation, not the t-critical value nor the confidence interval. Grad students should modify the p-value and t-critical value and produce appropriate one-sided confidence intervals for the one-sided alternatives. This problem does not require a new output variable in the dataframe.
3. The following code

```
var.test(yvec~as.factor(trtvec))$p.value > alpha
```

creates a logical value that is TRUE if the population variances may safely be assumed to be equal and is FALSE if the population variances are significantly different. In the case that the variances are not equal, it is preferable to use the following standard error formula to compute `stderr`:

```
sqrt((varvec[1]/nvec[1])+(varvec[2]/nvec[2]))
```

Use `ifelse` to allow for either standard error formula, depending on whether the equal-variances assumption is valid or not. Graduate students' output should include a character variable that reports which assumption was used. In addition, graduate students should change the final output object from a data frame to a list. Be sure to assign the list objects easy-to-read names.